

DETECTION METHODS OF MILK POWDER ADDITION IN PASTEURIZED AND UHT MILKS

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OBJECTIVE

This review aims to study the different indicators and techniques commonly used for the detection of milk powder addition in pasteurized and UHT milks.

Decree 2484/1967

“in all types of milk, whatever its nature, its reconstitution is forbidden for sale when it is intended for direct consumption”

Pasteurization

In batch	63 °C, 30 min
HTST	72 °C, 15-20 s

Sterilization

UHT	135°C, 2-10 s.
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**Economically Motivated
Adulteration**

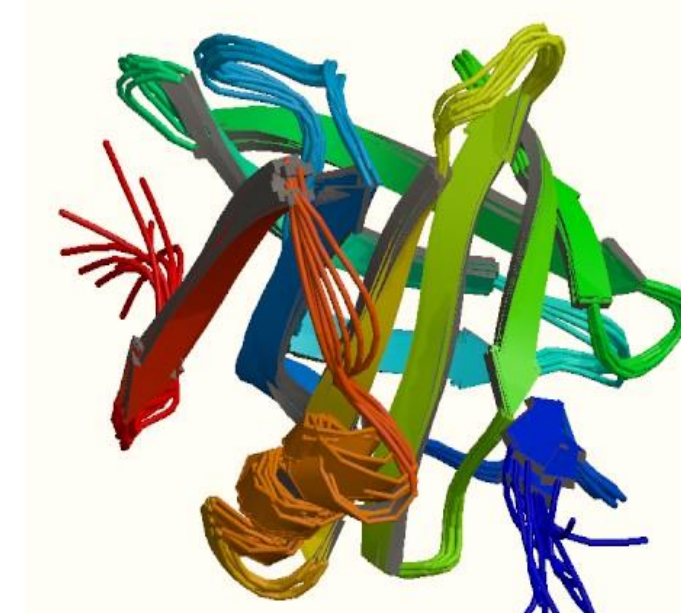


**Skim milk powder
manufacturing**



INDICATORS

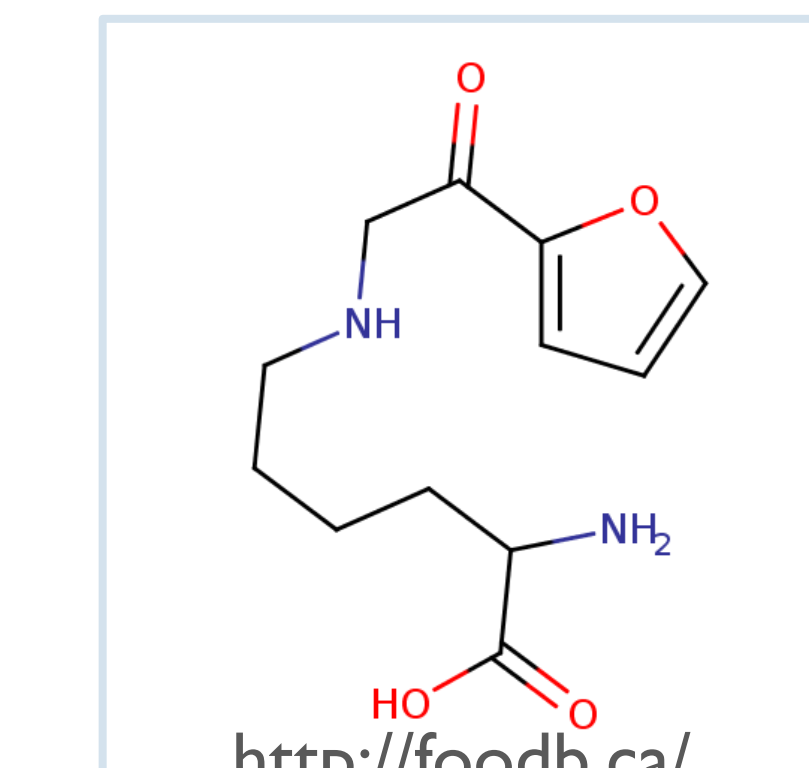
Denaturation



<https://www.rcsb.org>

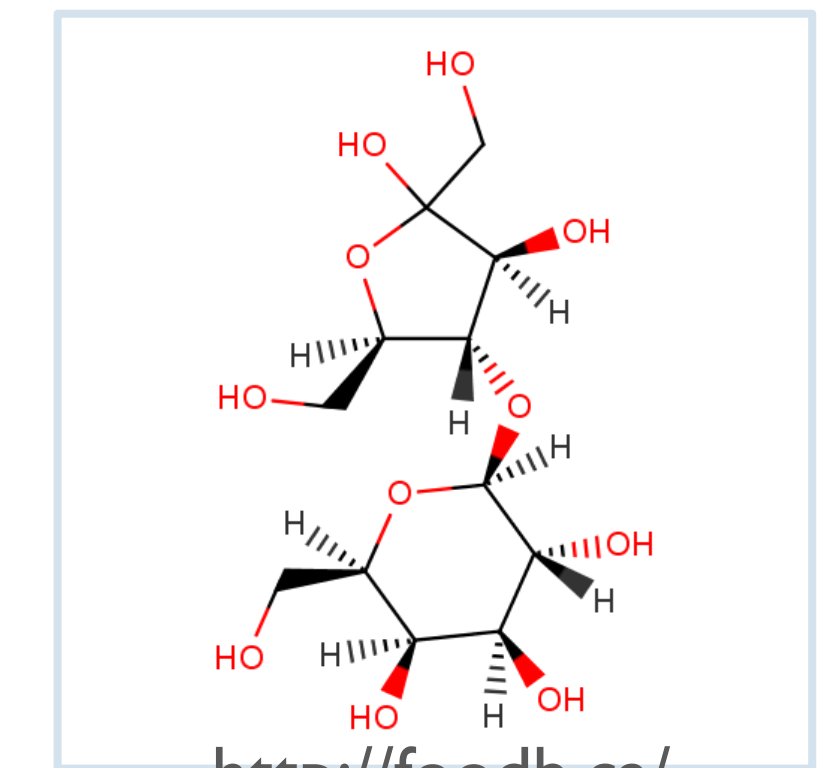
Beta-lactoglobulin

Maillard reaction



<http://foodb.ca/>
Furosine

Lactose isomerization



<http://foodb.ca/>
Lactulose

In pasteurized milk:

[Furosine] > 12 mg/100 g protein

In UHT milk:

$R_{L/F} < 6$

[Furosine] – $0.7 \times t > 190$ mg/100 g protein

[Furosine] = 140 ~190 mg/100 g protein, $R_{L/F} < 2$

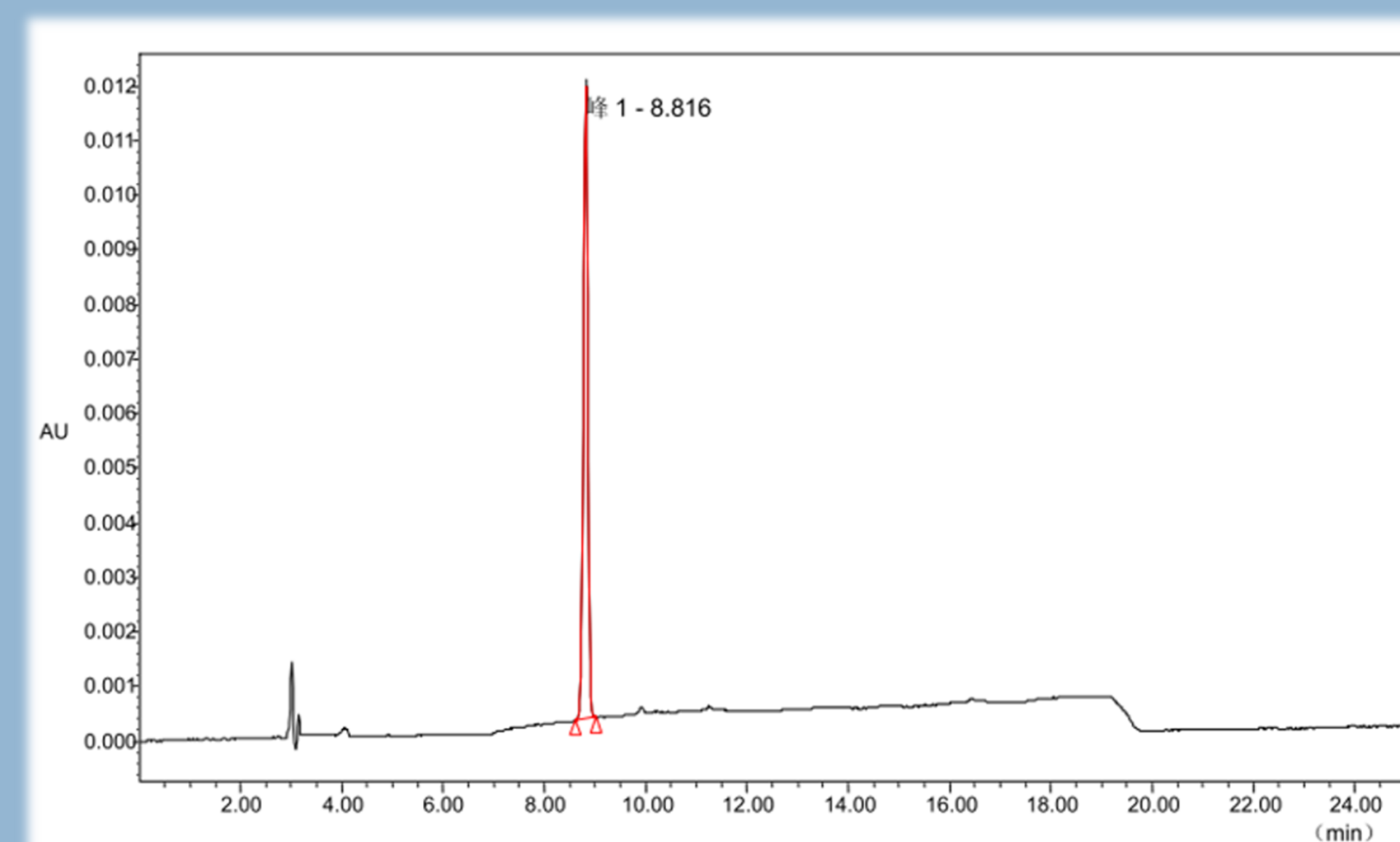
**The presence of
reconstituted milk**

DETECTION METHODS

CHROMATOGRAPHY

HPLC

- Hydrolyzed sample preparation
- C_{18} column
- Elution with a binary gradient
- UV detection at 280nm



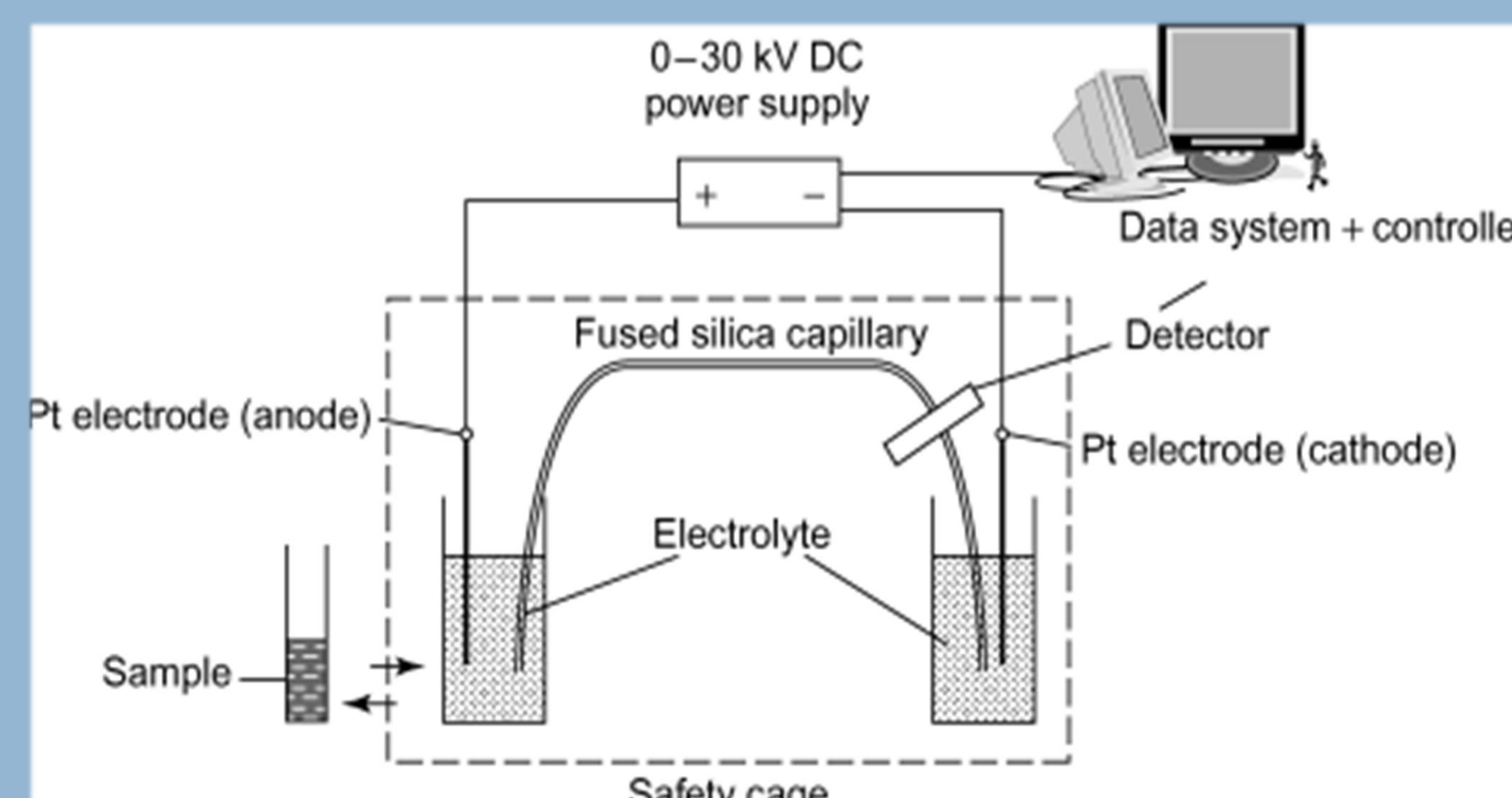
Furosine chromatogram. (NY/T 939-2005)

GC

- Trimethylsilylation
- Stainless-steel column (OV-17)
- N_2 , H_2 or He as carrier gas
- Flame ionization detector (FID)

CE

- Solid-phase extraction (SPE)
- Fused silica capillary
- Acidic running buffer
- UV detection at 280nm

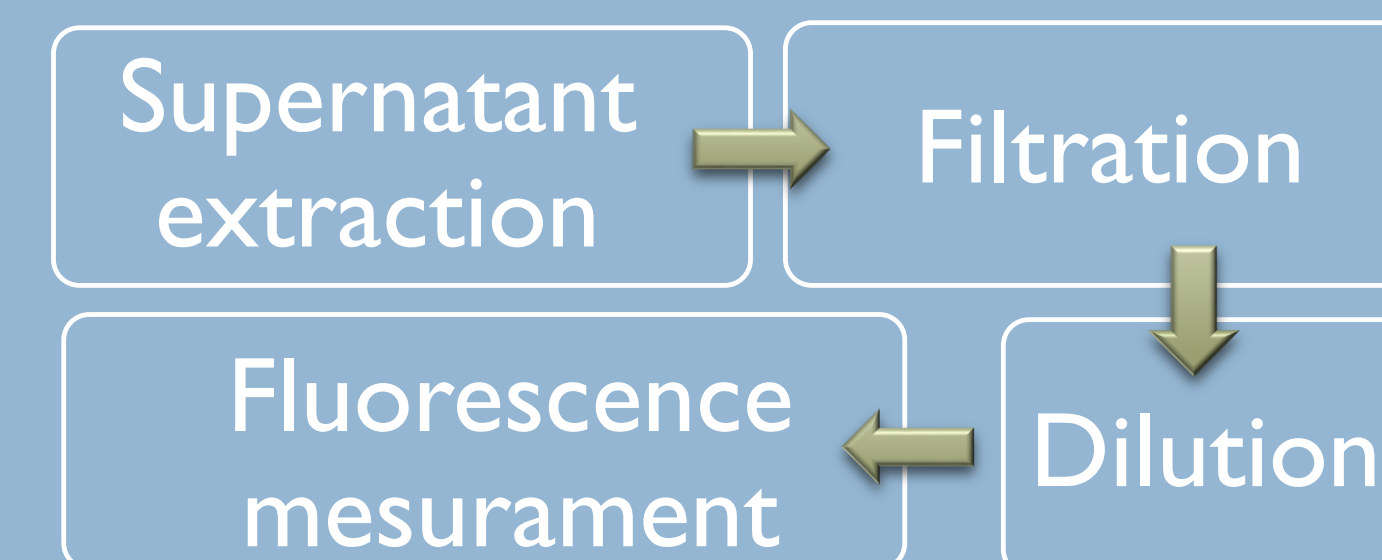


CE system.

Available in: <https://www.analyticaltoxicology.com> (17/01/18)

FLUORIMETRY

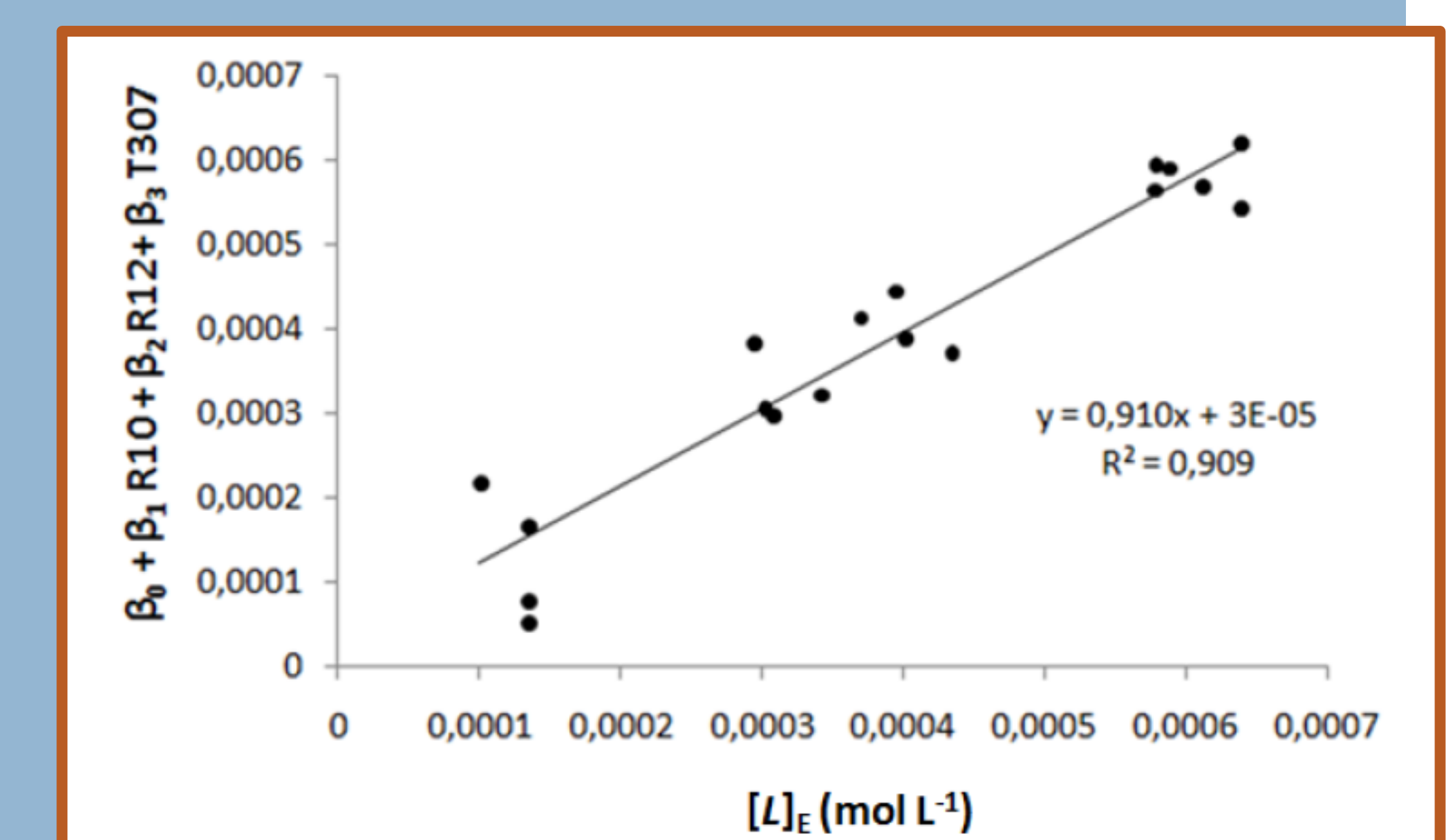
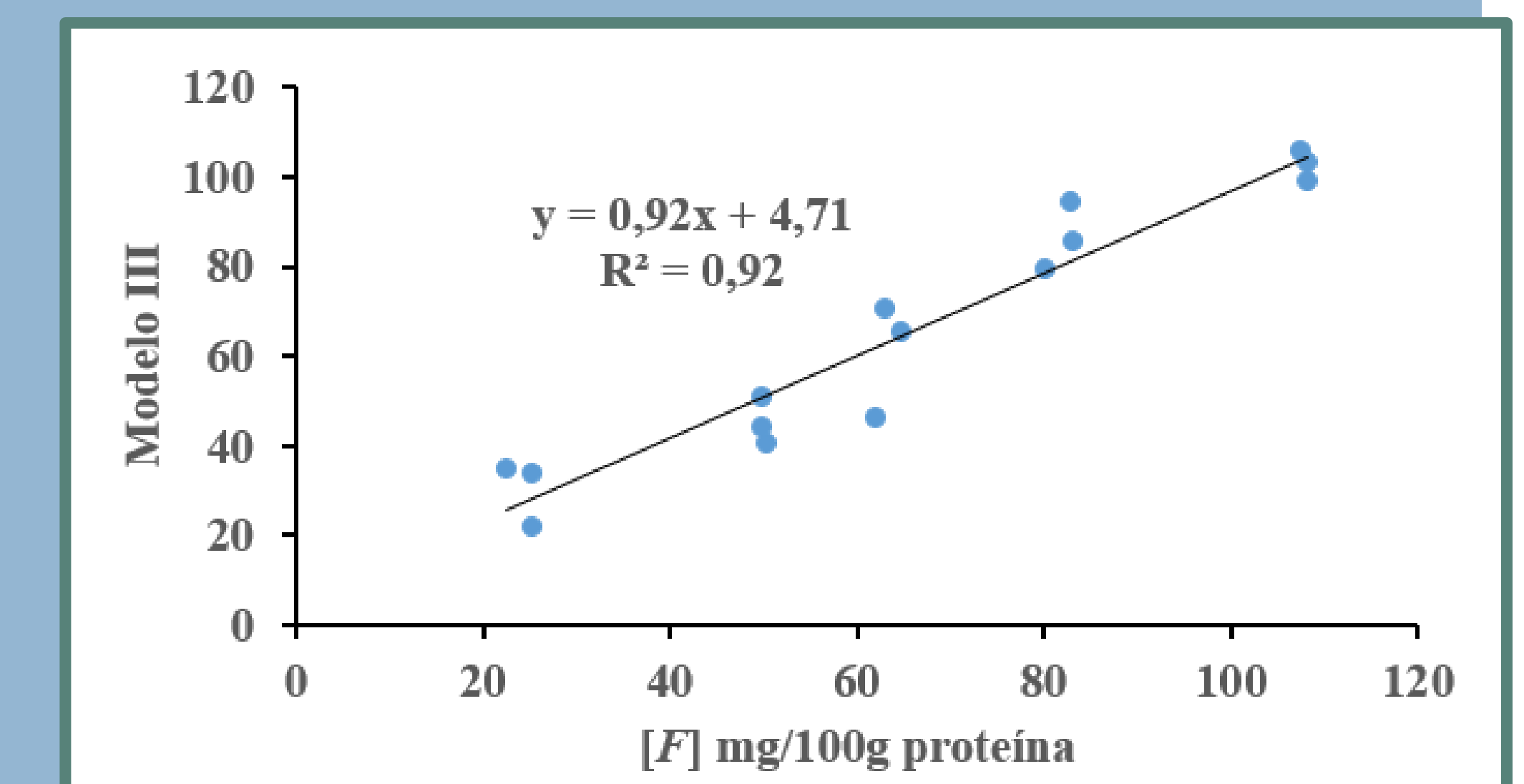
$$\text{FAST index} = \frac{F_{\text{AMP}}}{F_{\text{Trp}}} \times 100$$



FFFS

- Non-destructive and rapid
- Predictors:

riboflavin, tryptophan
Maillard compounds, dityrosine



Prediction curves of furosine and lactulose, respectively, at 90 °C.

CONCLUSION

- **Best indicators of milk powder addition:**
Furosine (HPLC,CE)
Lactulose (GC)

- **Correlation between lactulose and furosine as indicator**
- **Need for a reliable, fast and cheap detection method**
- **Potential of FFFS as non-destructive and fast method**